

Relaxation of the Supporting Structures of the Female Pelvis

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The purpose of this discussion is to share with you some thoughts about pelvic relaxation, its mysteries, some technical minutiae helpful in identifying them and some of the surgical problems involved. Thus, by looking at a number of these diagnostic challenges, you may be stimulated to some diagnostic thinking in an office setting.

Let me start with a few of the more deceptively simple challenges in pelvic relaxation, the goals we seek to achieve, and how to accomplish them.

We have seen within my generation a re-examination of sexual thinking whereby aging persons presume to continue a reasonably comfortable and satisfactory coital relationship well into their senior years. Solving a problem of procidentia or vaginal vault inversion by closing the vagina by LeFort colpocleisis or removing it by colectomy is no longer a solution equally acceptable to all concerned. If we are going to consider a surgical approach to reconstruction and rebuild for someone a vagina that is both physiologically and sexually useful, we must have some idea of the purpose and benefits we hope to achieve by reconstruction.

Consider, for example, the old illustration from *Cross-sectional Anatomy* by Eycleshymer

and Shoemaker (Fig 1), and notice that the vagina in this instance has an almost vertical axis. Is that then the goal we seek when we reposition a misplaced vagina? Or is the vagina being displaced anteriorly by a full rectum, which was full at the time of death, as this illustration obviously was from a cadaver dissection?

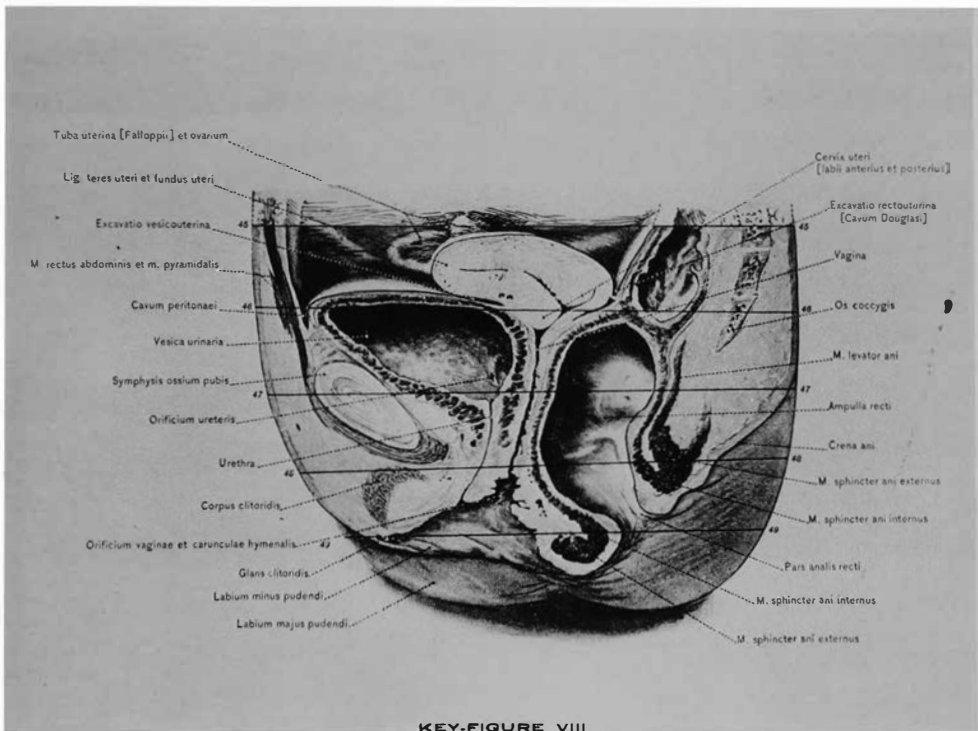
To resolve the issue, the vaginas of nulliparous young women can be lightly painted with a barium paste. This would not distort the vagina but would render it radio-opaque. Lateral colpograms taken of these women demonstrate that the vagina does have an S-shaped curve with a horizontal inclination to the axis of the upper vagina (Fig 2). If we were to ask these nulliparous patients to bear down, as by a Valsalva maneuver, this upper axis would become even more horizontal (Fig 3).

We can confirm this for ourselves daily in the office during vaginal examination of a nulliparous patient by letting the examining fingers follow the axis of the vagina. Usually the fingertips will end up in the hollow of the sacrum.

The usual upper horizontal vaginal axis is clinically significant and I will now discuss how this axis can be destroyed or changed and some of the surgery that can be done to restore it. The vagina in this situation rests on the generally empty rectum. The only time the rectum is filled is in the patient with a large rectocele, or in someone during the act of defecation, or in someone recently deceased. The empty rectum in turn "sits" on the levator ani. The portion of the levator ani behind the rectum upon which it rests is called the levator plate. It is formed from

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KEY-FIGURE VIII

Fig 1—Drawing of sagittal section through the embalmed cadaver showing the axis of the vagina to be in an almost vertical position. It is displaced anteriorly by the dilated rectum, a relationship not often found in the living.

the fusion of the two halves of the pubococcygeal muscle posterior to the rectum (Fig 4).

How many different anatomic entities or "systems" are there concerned with keeping the vagina inside the body? It is really an invagination, and it is unlikely that without help it would remain one. Invagination has many conceptual similarities to the finger of an in-turned rubber glove; by putting air into the glove and squeezing an in-turned finger promptly pops out. Why then does the vagina not "pop out" or evert more frequently than it does? What are the systems that affected, damaged, or missing parts can influence? Why is the birth canal where it is?

There are actually at least six responsible but independent systems that influence invagination. The first is the bony pelvis to which most of the soft tissues of the pelvis are ultimately attached. If there is a defect in the bony pelvis, for example, a congenital defect coincident with extrophy of the bladder, the mid-portion of the pubis may be missing in which case

the rectus muscles and pubococcygeal muscles have a defective attachment influencing greatly the architecture of the anchoring supports of the vagina.

Second among the six systems is the round and broad ligament complex; third, the cardinal-uterosacral ligament complex; fourth, the pelvic diaphragm; fifth, the urogenital diaphragm; and sixth, the perineum and the perineal body. Let us examine these in some detail to see why they influence pelvic support.

We know, for example, that the round and broad ligament complex often influences pelvic support in a negative way. If the broad ligaments have been involved with either endometriosis or ligneous fibrosis as a result of previous infection, or sometimes by cancer, what would appear to be an easy vaginal hysterectomy isn't easy at all. The uterus is arrested in its descent by pathologic fixation from the broad ligament. Certainly the role of the round ligaments as attributed to retro displacement of the uterus is always up for constant reexamination, particularly



Fig 2—A normal vaginal depth and axis. The vaginal walls of a 25-year-old, healthy nulligravida have been painted with barium. The perineal curve of the lower vagina is shown along with a more horizontal axis of the upper vagina.

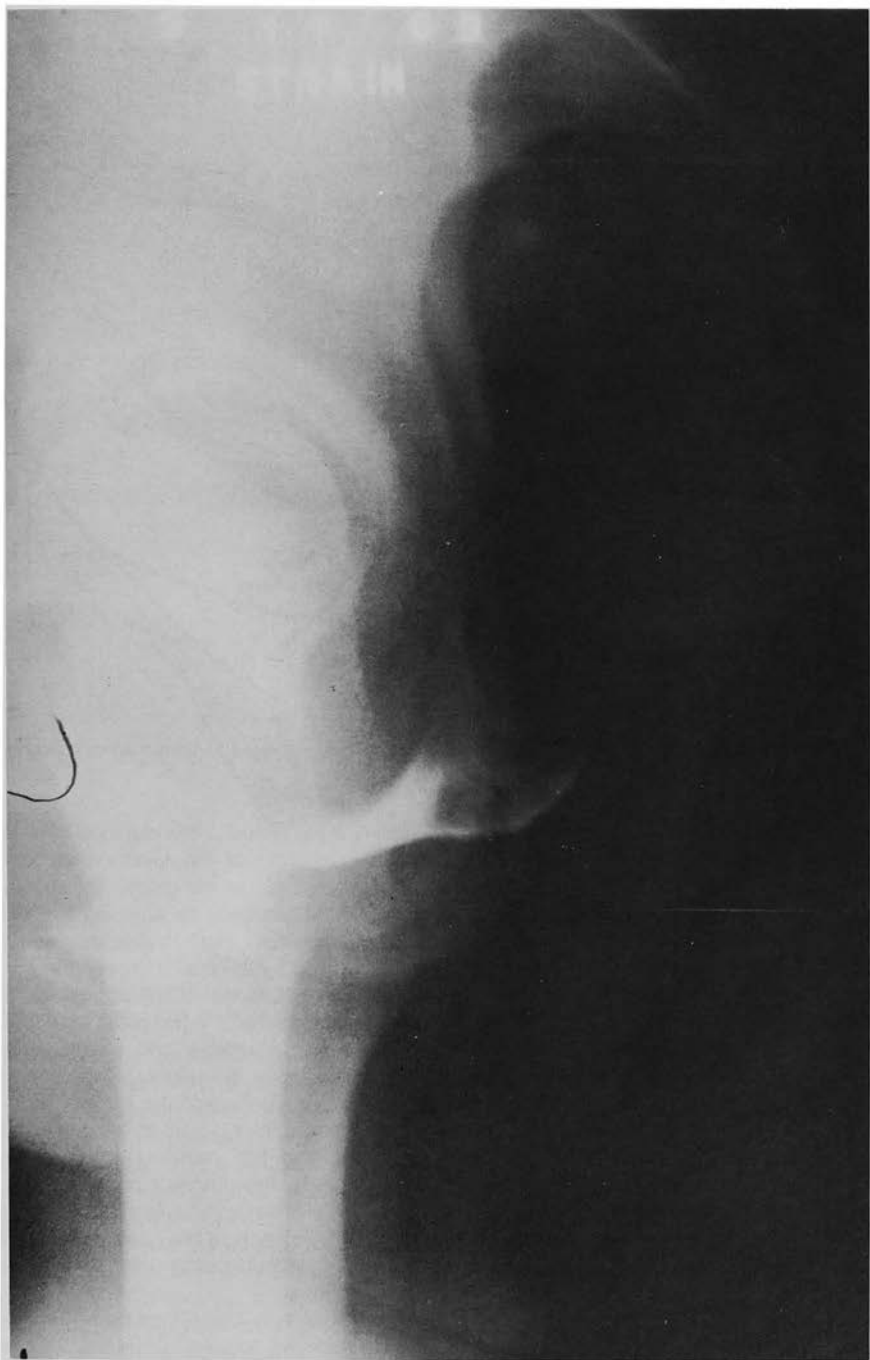
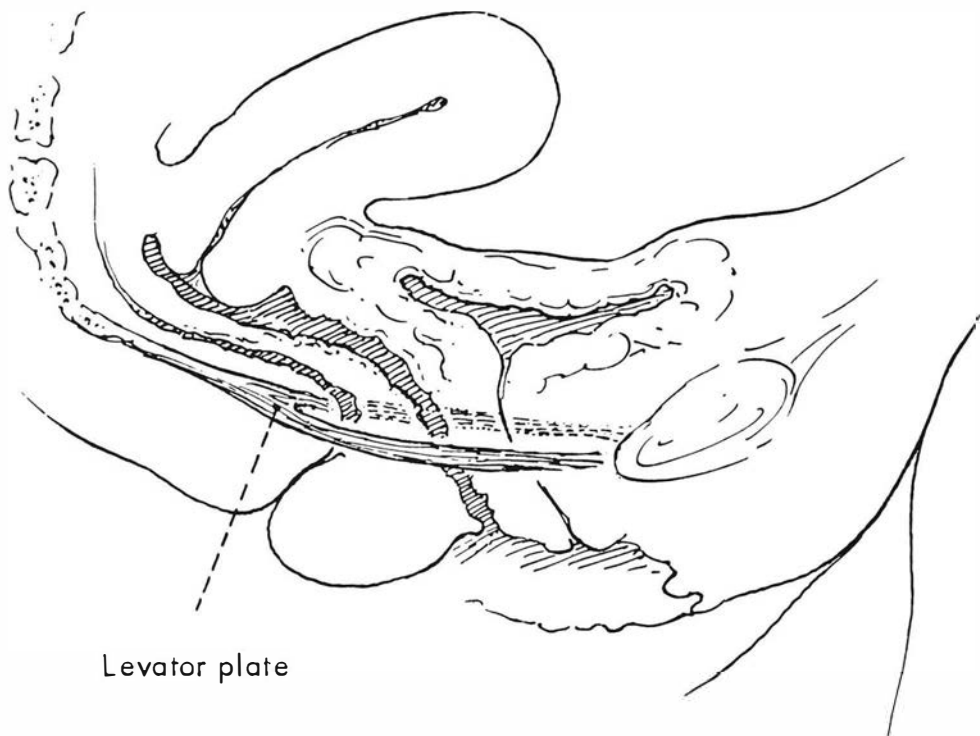


Fig 3—The same patient is straining as by a Valsalva maneuver which accentuates the horizontal axis of the upper vagina.



Levator plate

Fig 4—Drawing of normal vaginal axis of the living showing almost horizontal upper vagina and rectum lying on and parallel to the levator plate.

in view of Blue Shield's national decision to exclude suspension operations from those authorized for payment. I do not believe that retroversion causes uterine prolapse, but that in many instances the same qualities that lead to retroversion may also lead to the development of genital prolapse. These conditions may be separate results of common etiologic circumstances. The significance of this observation is that suspension of a retroverted uterus does not of itself prevent subsequent prolapse.

We consider the cardinal ligaments together with the uterosacral ligaments as a single anatomicosurgical suspensory unit: the cardinal-uterosacral ligament complex.

The pelvic diaphragm consists of the levator ani and its fascial covering, the medial portion of the levator ani. The pubococcygeal muscles fuse behind the rectum, constituting the levator plate which is so important in pelvic support. The normally horizontal axis of this plate will sag if the diaphragm has lost its integrity. Not

only will the hiatus or the distance between the anterior margin of the levator plate and the pubis increase, but the greater the sagging the greater the tendency for anything that rests on top of this levator plate to slide over and down, accentuated by the pull of gravity (Fig 5).

The urogenital diaphragm is a sort of sandwich between the two pubic rami. It is penetrated by the urethra and vagina, and also helps to support the urethra. The pubourethral ligamentous support of the urethra is, in fact, continuous with and part of the urogenital diaphragm, and has much clinical significance. Obstetrically, the posterior portion of this ligament is the one most likely to be damaged. Pathologic stretching may cause rotational descent of the bladder neck predisposing to stress incontinence.

There is a big difference in the perineal body between persons. Defect of the perineal body may be inherited, and occasionally a perineal body will be missing even in nulliparous

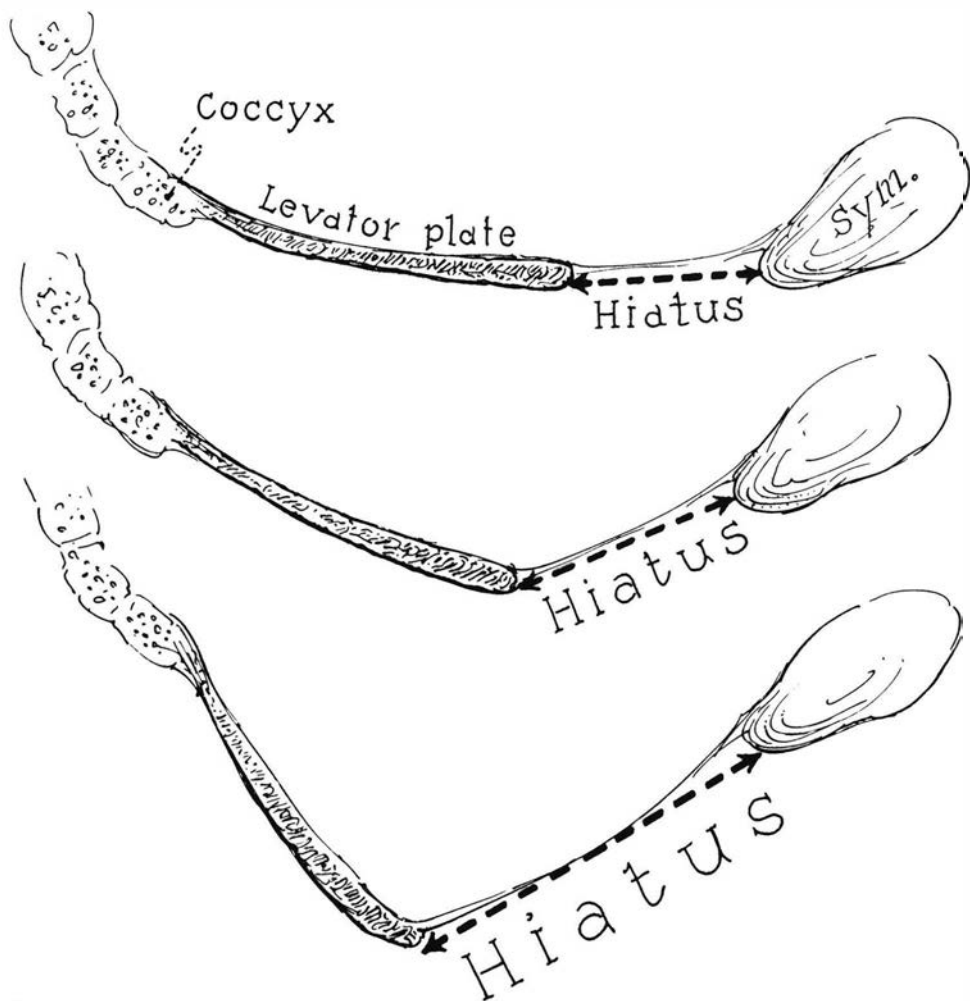


Fig 5—As the levator plate tips, the genital hiatus becomes larger as shown. In addition, the pull of gravity and the forces of intra-abdominal pressure accentuate the strain upon pelvic suspensory system.

women. A defective perineal body is sometimes confused with a rectocele, and if congenital in origin, is usually asymptomatic unless there is a total absence of the perineum, in which case the patient is said to have a so-called "double-barrelled shotgun" type of vagina, and the vaginal canal is often contaminated by rectal soiling; such a patient has a virtual cloaca. The urethra essentially lies upon the perineal body; in instances in which a urethral repair has been done and a perineal defect is evident, correction of the perineal defect is complimentary to the support of the urethra and anterior vaginal wall.

The combinations of damage to the six different anatomic systems responsible for pelvic support that can be produced indicate why there is no one standard surgical procedure, for example, vaginal hysterectomy and repair or the Manchester procedure, that will solve all combinations of problems equally well.

There can be permanent elongation and stretching of the cardinal and uterosacral ligament complex permitting descent of the upper vagina but without any particular cystocele or rectocele. This may be acquired and is often quite significant. The process may be set in motion in someone who has had the misfortune of

being told to bear down during labor prior to full dilation of the cervix, and in so doing has pushed the cervix in front of the presenting part of the fetus. Many times that advice to bear down prior to full dilation has been accepted by the patient as a hopeful, though false and unknowingly dangerous means of shortening labor. It has often done intractable and permanent damage to the supports of the vagina.

In another situation, failure to perform an episiotomy in someone in whom vaginal elasticity is defective may result in a cystocele and rectocele, even in a patient who did not bear down prior to full dilation of the cervix. We are in an era where there are some young women who don't want an episiotomy and who are questioning circumcision, as well as the need for hospital delivery even if operative intervention of any kind in the conduct of their labor is indicated. We can rest assured that some can get by without episiotomy, but many can not without sustaining serious damage. How can one tell the difference? Probably the most important single point is separating the care of those who have elasticity of the vagina and perineum from those who do not.

The so-called older primipara, the patient over 35, generally has reduced elasticity of the vagina and particularly the lower portion and the perineum. One can also distinguish the patient with poor elastic tissue by the presence of striae on the sides of the abdomen. The patient with many abdominal or breast striae is usually an obvious candidate for episiotomy if excessive vaginal damage is to be prevented. Episiotomy must be performed at a proper time; not just to prevent a tear, but before irreparable damage has been done to the soft tissues. Lastly, an episiotomy must be properly repaired with the goal of reuniting structures which were transected by episiotomy, and not simply just stopping the bleeding and putting the skin together.

Anterior colporrhaphy is not so simple as it would appear from the three or four pages given in the average surgical text, so let us look at some of the reasons why.

A typical conception of cystocele shows some pathologic stretching of the bladder that displaces the vagina downward. Are the symptoms that may be produced so predictable that reconstruction is always simple? The relationship between the bladder, the urethra and the

posterior surface of the pubis has much clinical significance with or without a coincident cystocele.

Consider some of the various alterations that an anterior vaginal wall can undergo. Many years ago a characteristic descent of the base of the bladder during the act of voiding was emphasized so that the vesicourethral junction may be represented as a straight line. While this is physiologic during the act of voiding, it is not to a patient at rest who is not voiding; thus, when this flattening is apparent in someone who is not voiding, it indicates rotational descent or "wheeling" of the vesicourethral junction with elongation of the supporting tissues concerned with holding the urethra in its normal position. Such an altered relationship may be a significant factor in the production of stress incontinence as the vesicourethral junction may now be the lowest portion of the hydrostatic column of water. We know that incontinence may result from an abnormal relationship between intraurethral pressure and intravesical pressure as a function of urethral tone and not solely from positioning of the vesicourethral junction. A cystocele may or may not coexist. The anterior vaginal wall may thus bring down with it the base and neck of the bladder, but not the bladder proper; this is not a cystocele in the usual sense. Sometimes rotational descent of the bladder neck has been called "urethrocele," and one will find many references to this fallacy in the literature, but a true urethrocele is a pathologic dilatation of the urethra and is very rare. I think in my whole operative experience I've seen but three or four true urethroceles. Some of these people with a true urethrocele are perfectly continent. Rotational descent of the bladder neck is also sometimes called "pseudocystocele."

In addition, there may be funneling of the urethra. If the urethra is funneled in addition to the rotational descent of the bladder neck, a yet different set of statistics prevails, whereby the bottom of the hydrostatic column of urine normally located at the base of the bladder is now located at the base of the funnel, thus reducing intraurethral tone and pressure and increasing the susceptibility to stress urinary incontinence.

If a patient has a cystocele serious enough to require anterior colporrhaphy, the operator should probably repair the full length of

the vagina and make sure that the vesical neck is adequately supported and that the cystocele is not repaired with more tissue than required, thus risking the development of iatrogenic stress incontinence from unwitting flattening of the posterior urethrovesical angle. Neither should a cystocele be repaired with less tissue than required. The vagina should be precisely trimmed to a size suitable to the particular needs of the patient.

A perineal defect with a rectocele is a factor in the defective support of the urethra. If the urethra and anterior vagina rest on nothing of substance, any operation that has been done to them will tend to have less mechanical support than if the anterior vaginal wall rests on something of strength. Rectoceles come in various sizes and shapes within the pelvis; some produce symptoms and some do not. It is difficult to improve a patient's comfort by surgical correction of something that is asymptomatic and a surgeon would not normally operate on a rectocele or cystocele if it were producing no symptoms distressing to the patient and if the repair were not part of additional pelvic surgery. But if a vaginal hysterectomy were performed because of menorrhagia, prolapse, fibroid or something of that nature on a woman who has a coincident cystocele and rectocele, certainly the cystocele and rectocele ought to be repaired at the same time.

Let us now briefly consider enterocele. It is sometimes described simply as a peritoneal hernia. Sometimes symptoms are produced, sometimes not. Symptoms associated with an enterocele are caused by gravity-induced traction upon the contents of the sac: small bowel or omentum. If the sac is in fact empty, the patient will be relatively asymptomatic. But the sac is a potential site for further distress and should be removed if surgery is being performed on other parts of the pelvis.

Consider the difference in the relationship between the cul-de-sac and the vagina in the congenital type of enterocele versus pseudo-enterocele. The latter may be seen in a person in whom a high rectocele was treated by perineorrhaphy alone. Perhaps the doctor was not aware how high this rectocele extended because with the patient asleep and in the lithotomy position it is sometimes difficult to judge how it looks when the patient is standing. Fail-

ure to repair the full length of the rectocele gives rise to this condition which resembles an enterocele but isn't and is usually symptomatic, the symptom being inability to completely empty the bowel. The sac, which is unrepaired rectocele, fills with fecal material, and the patient cannot evacuate it except by digital pressure in the vagina. A simple maneuver distinguishes enterocele from high or midvaginal rectocele or dropped cul-de-sac which is a function of support of the vault of the vagina. Because enterocele is most evident when the patient is standing, she should be examined in that position: index finger in the rectum, thumb in the apex of the fully replaced vagina and the patient asked to bear down. If enterocele is present, the physician can feel it fill with either small intestine or omentum. When gently squeezed between the thumb and forefinger, discomfort is evident. In that way the physician can distinguish preoperatively between enterocele, which is a sliding hernia, and descent of the cul-de-sac in someone in whom the vagina has dropped.

Failure to recognize and treat variances by appropriate surgery usually leads to post-operative disability.

One of the different approaches to the problem of massive eversion of the vagina has been ventral suspension or fixation of the everted vagina. Sometimes it is successful, but the 90 degree change in the usual axis of the vagina imposes a risk that would otherwise not be present. Pulling the vagina forward without obliterating the cul-de-sac has made the latter vulnerable to enterocele; a future enterocele that might not have been there had the cul-de-sac been obliterated. This risk is also present following some other surgical procedures that may change the axis of the vagina, if no attempt has been made to obliterate the cul-de-sac. For example, unless the peritoneum is opened and the cul-de-sac deliberately obliterated, the Marshall-Marchetti retropubic pin-up type of operation will be followed by a significant incidence of subsequent enterocele requiring a second operation.

A transabdominal approach to eversion of the vagina with the aim of restoring a sexually useful vagina is sacropexy. Affixing the vault of the vagina to the hollow of the sacrum has an advantage over ventral suspension in that the

normal vaginal axis is restored and the cul-de-sac is no longer vulnerable.

We have considered a variety of different kinds of damage to the supports of the pelvis. Let us consider the causes of damage.

1. *Congenital defect*: not only a missing or underdeveloped tissue or organ but a defective innervation. Striated muscle deprived of an adequate nerve supply may be hypotonic.

2. *Increased intra-abdominal pressure*: An obese woman may wear a girdle that is too tight; maybe she is doing heavy work; or there is the older woman in a situation where a loved one, sometimes a parent, has become disabled by a stroke. That disabled patient must be manually lifted in and out of the bed, in and out of the bathtub, on and off the commode, producing a massive increase in the intra-abdominal pressure of the person doing the lifting. Often there is no one else to do the lifting, but we see the consequences of that damage.

3. *Obstetric damage* can be caused in a number of different ways. In the 1940s we participated in problems of home delivery, usually among the poor in the large cities, as part of the home delivery service. Delivery was conducted reasonably comfortably, but the consequences of soft tissue damage during labor were some-

times greater than would have been seen in the hospital. Now there is some revival of interest in nonsupervised obstetric performance. Women are delivering one another, and there may be a significant return of some of these problems of genital prolapse that have not been so common recently. Obstetric damage, even if in a hospital, is often related to the conduct of labor. We are considering the supports of the urethra. Remember the damage they can sustain. There are at least six different combinations of damage to the anterior vaginal wall. If the baby's head is very closely applied to the undersurface of the pubic arch during labor, it may damage these tissues in contrast to circumstances in which, because of either a larger fetal head or a narrow arch, the baby's head is pushed away from these tissues beneath the urethra (Fig 6). Two more types of damage to the vagina, and secondary damage to the bladder, have to do with the conduct of labor. In the first instance, the vagina has been damaged from within out. An "explosion" type of damage has occurred in which the vaginal wall has been stretched beyond its limits of elasticity—much like a piece of crepe paper that has been stretched and at a certain point loses its elasticity and is permanently stretched out of shape. In contrast

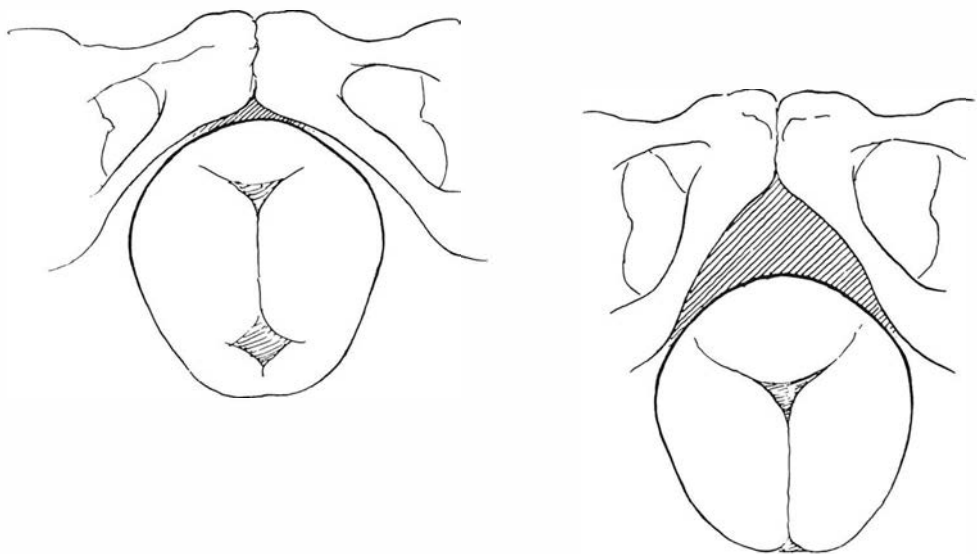


Fig 6—Obstetric damage to the anterior vaginal wall may be greater when the baby's head has come in close contact with the tissues beneath the pubic arch (*left*). Posterior displacement of the baby's head during labor (*right*), is more likely to concentrate damage on the attachments of the posterior vaginal wall, sparing some anterior damage.

is a circumstance in which the labor patient has been told or has found herself bearing down prior to full dilatation of the cervix and pushes the cervix in front of the baby, overstretching the cardinal and uterosacral connective tissue supports of the cervix. Even when the cervix is fully dilated, the vagina may fail to dilate and the patient may push the vagina in front of the baby, almost like a doughnut, stretching the vagina itself in addition to stretching the supports, accounting for some of the combination damage. So our old friend the cystocele is not quite so simple as it appears on the surface. If one adds the distention cystocele, the one produced by overstretching, and the one from displacement to those six kinds of damage previously alluded to, there are now eight types.

With displacement cystocele, the vaginal wall may not have been stretched out of shape, but it is in the wrong place. There are reasonably good rugal folds in each vaginal wall. This patient requires major attention to restoration of the supports of the cervix and the vagina and less attention to reconstruction of the anterior vaginal wall itself. With displacement cystocele, the bladder has been pulled down from its normal position by the prolapsed uterus and by its attachment to the cervix.

The goal of most surgery for urinary stress incontinence includes elevation of the vesico-urethral junction to a point where it is once again within the abdomen and, therefore, presumably responsive along with the bladder to changes in intra-abdominal pressure.

The symptoms of genital prolapse are those of pelvic heaviness, backache, vaginal mass, dyspareunia and disorders of function primarily related to coitus or inability to empty the bladder or rectum. The patient may have to manually elevate the bladder in order to empty it or make digital pressure within the vagina to overcome inability to empty the rectum. When these symptoms are sufficiently disabling, or if they are progressive, the patient should indeed be treated.

The treatment includes different kinds of prophylaxis. If the patient is a heavy smoker with emphysema, asthma, or chronic bronchitis, successfully getting her to stop smoking will lessen the insults placed on the supporting

tissues by coughing. If the patient is too fat, she should lose some weight. If she's wearing a girdle that is too tight, she should stop wearing it and either lose the weight or buy a larger garment. If she is working at an occupation that requires heavy lifting, for example, a dipper in a bumper replating factory, or someone in nursing who is required to lift patients and is developing a genital prolapse, she should try another occupation. The pessary isn't used very much anymore, although it is frequently used temporarily to replace the dropped tissues in someone awaiting surgery. Inserted and left as a definitive treatment, a patient will be temporarily comfortable enough that she may postpone surgery until a time when she is much older and unable to respond to the stress of surgery as smoothly as when younger. Pubococcygeal perineal resistive exercises and voluntary contraction of the pubococcygeal muscles, the Kegel exercises, are certainly helpful in relieving many of the symptoms. They must be done often enough: 20 contractions in a row, three seconds each, six times a day, for at least three months. Advise the patient that she can do them while in public, as the contractions can't be seen. The physician can usually perceive the patient's pubococcygeal strength by putting one finger in her vagina and asking her to squeeze her vagina shut. One can feel whether her pubococcygeal muscles are strong, and if they are not, estrogen replacement supplemental to surgery will improve healing qualities and tissue strength.

We have considered many aspects of genital prolapse including the clinical anatomy, sites of damage, causes and prevention of genital prolapse and a variety of treatments. Most can be readily recognized if we but take the time to look for them.

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